REMARKS

Claims 1-16 are pending in the application. Claims 10, 13, 14, and 15 are amended herein. Claim 16 is new.

In item no. 2 of the Office Action, the Examiner raises an objection because there are two consecutive claims numbered as claim 13. Applicant has renumbered the second of these claims as claim 14.

In item no. 3 of the Office Action, the Examiner objects to claim 15 as lacking proper antecedent basis. Applicant has amended this claim to provide proper antecedent basis.

Claims 1-5, 13, and 15 are rejected under §102(e) as being anticipated by Hoppe (U.S. Patent No. 6,046,744). As to claim 1, the Examiner cites to Hoppe for its teachings related to determining a function, and for its teachings related to defining a surface in terms of one scalar per point relative to the function. In point of fact, however, the methods taught by Hoppe are entirely distinguishable from, and fall far short of anticipating, the element of claim 1 that reads "defining the surface in terms of one scalar per point."

Generally, Hoppe discloses a method for "progressive mesh representation", which incrementally refines an arbitrary mesh M from its coarsest representation M^0 to its most detailed representation, M^n. Hoppe, col. 5, lines 24-39. Hoppe accomplishes this by maintaining "detail records" with each mesh representation M^i (where $i < n$). Hoppe, col. 5, l.30; col.6, lines 4-6. The detail records contain information that enables a more detailed representation to be derived from the next coarsest representation (e.g. M^1 derived from M^0). Specifically, the information stored in the detail records contains instructions for performing a "vertex split", which is an elementary feature of Hoppe whereby an additional vertex may be added to the mesh to form a finer representation. Hoppe, col.5, lines 32-35. However, the vertex split is fundamentally different from the method of the present invention, because it results in vertices that are connected by general polylines, and hence, not definable in terms of one scalar per point (i.e. one scalar per vertex).

The present invention represents a surface by forming a normal mesh, which is composed of normal polylines as opposed to general polylines. In one embodiment, the normal mesh is an approximation of the surface using a mesh composed entirely of isosceles triangles. The vertex

location of each triangle is determined by a single "detail coefficient", or "scalar". Application, p.3, lines 19-20. The scalar defines the length of a "normal polyline", which extends in a normal direction from the midpoint of the base of the triangle, to the vertex point. Application, p.3, lines 16-23; p.5 lines 7-12. Starting with a coarse representation of the surface (e.g. determining a function as in the first step of claim 1), the method of this embodiment of the present invention can progressively derive surface representations of finer detail by forming successive groups of isosceles triangles based on information consisting of one scalar per vertex. Application p.5, line 21 to p.6 line 17. Thus, each new vertex may be derived from a single scalar that represents the length of a normal polyline.

To illustrate a fundamental difference between a mesh representation of the claimed invention and a mesh representation using the method of Hoppe, reference is made to Figures A through D, which are attached to this paper as page 9. Figures A and B are a reproduction of Figure 13 of Hoppe, which illustrates a "vertex split" used to produce a finer mesh representation of an object surface having a boundary M. Boundary M is an arbitrary surface that has been superimposed on the figure. Note that the vertex split does not produce isosceles triangles, and that as a result, areas 294-297 are bounded by general polylines. Note also that *because* areas 294-297 are bounded by general polylines, the Hoppe method requires storage of additional scalar information, e.g. to characterize corners 301-308. Hoppe, 20:45-60. In contrast, Figure C illustrates application of an embodiment of the method of the present invention to produce a mesh representation of the surface bounded by M, using one scalar per vertex. Starting with the line segment between vertices 284 and 285, a new vertex X is derived from a single scalar value and located at the end of a polyline X' extending normally from the midpoint of line 286-287 to the boundary M, and having a length equal to the scalar value. An isosceles triangle has now been defined by points 284, 285, and X. A finer level mesh can then be derived as shown in Fig. D, where new vertices Y and Z are located, each according to a single scalar value representing the length of a polyline Y' or Z' extending from the midpoint of lines 284-X and 285-X, respectively, to the boundary M. Using this method, finer levels of representations of M may be derived using one scalar per point that defines the length of a polyline extending normally from the midpoint of the base of a triangle formed in the coarser level representation.

In further distinguishing Hoppe from the present invention, Applicant also notes the advantages inherent in defining the surface in terms of one scalar per point. By minimizing scalar information, a computer graphics program based on the present invention has less information to store, and thus, data compression is generally simplified. In item 5 of the Office Action, the Examiner argues that Hoppe teaches a method of defining a surface in terms of one scalar per point. Actually, the "vertex split" method of Hoppe requires storing far more information than one scalar per vertex point. A "vertex split" transformation requires storage of a *set of information* that represents vertex attributes, including the positions of the two affected vertices, the two discrete attributes of the two new faces, and the four scalar attributes of the affected corners. Hoppe, col.10, lines 42-54. Each "vertex split" record "comprises indices of the vertices v_s, v_l, and v_r; the position coordinates v_s^n, and v_t^n of the vertices v_s and v_t; the discrete attributes d{vs, vt, vl} and d{vs, vt, vr} of [the two adjacent] faces; and the scalar attributes [s1], [s2], [s3], and [s4] of the corners of the faces." Hoppe, col.12, lines 3-10. Furthermore, a single vertex in Hoppe is defined according to three coordinate values (x, y, z), which would require the storage of three scalars per point as opposed to one. Hoppe, col.11, line 37-38. Thus a computer program based on Hoppe would generally be more cumbersome to compress, due to a much greater total amount of information storage required to refine a surface representation.

In view of the above, Applicant asserts that the Examiner's rejection of claim 1 cannot be sustained. It therefore follows that the Examiner's rejections of claims 4-12, each of which is dependent on claim 1, should also be withdrawn.

As to claim 13, Applicant has amended this claim to further distinguish it over Hoppe. Applicant submits that claim 13, as amended, is neither taught nor anticipated by any of the paragraphs cited by the Examiner, nor anywhere else throughout the Hoppe disclosure.

As to claim 15, Applicant has amended this claim to further distinguish it over Hoppe. Applicant believes that claim 15, as amended, is neither taught nor anticipated in any of the paragraphs cited by the Examiner, nor anywhere else throughout the Hoppe disclosure.

In view of all of the above, it is respectfully submitted that all claims are allowable. The Examiner is therefore requested to allow all claims and pass this application to issuance.

In papers enclosed with this Response, Applicant has included authorization to charge Howrey Deposit Account No. 08-3038 for a two-month extension fee. Applicant believes no

other fees are due. If any additional fees associated with this Response are in fact due, the Commissioner is hereby authorized to charge Howrey Deposit Account No. 08-3038 for the same referencing Howrey Dkt. No. 01339.0010.NPUS01.

Respectfully submitted,

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